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ABSTRACT

This vocational program guide is intended to assist in the organization, operation, and evaluation of a program in industrial machinery maintenance and repair in school districts, area vocational centers, and community colleges. The following topics are covered: job duties of millwrights, maintenance mechanics, and machinery erectors; program content (curriculum framework and student performance standards); program implementation (student admission criteria, cooperative education, and student organization participation); instructional resources; facilities (facility design requirements and safety, maintenance, and liability); suggested equipment; and professional development (teacher updating and teacher standards and related professional organizations and support services). A Career Merit Achievement Plan (Career MAP) for use in recording the progress of students enrolled in an industrial machinery maintenance and repair program is packaged with the program guide. Included in the Career MAP are a list of relevant job titles, overview of the MAP and directions for using it, guidelines for rating student performance standards, charts detailing the various subcompetencies of the industrial machinery maintenance and repair skills and work environment readiness skills covered in the industrial machinery maintenance and repair program. (MN)

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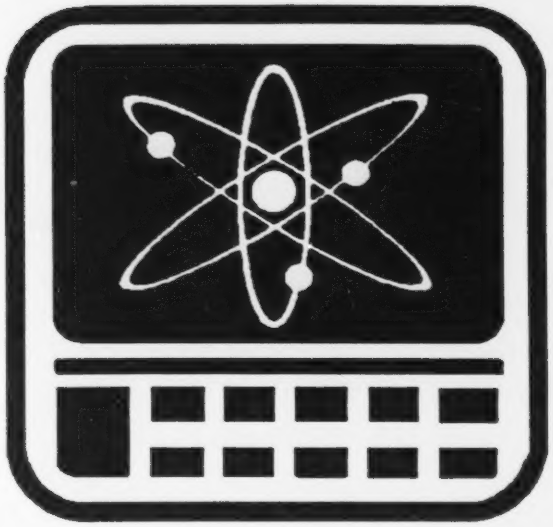

FLORIDA VOCATIONAL PROGRAM GUIDE FOR INDUSTRIAL MACHINERY MAINTENANCE AND REPAIR

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CONTENTS

Acknowledgements i

Table of Contents iii

Introduction 1

Occupational Description 3

Program Content 5

Curriculum Framework 6
Student Performance Standards 8

Program Implementation 13

Student Admission Criteria 14
Cooperative Education 19
Student Organization Participation 20

Instructional Resources 23

Facilities 43

Facility Design Recommendations 43
Safety, Maintenance and Liability 46

Suggested Equipment List 49

Professional Development 59

Technical Updating and Teacher Standards 59
Related Professional Organizations and Support Services 60

INTRODUCTION

Vocational education meets the needs of students desiring to pursue a selected vocation and is designed to provide training that is realistic in meeting present and future employment opportunities. In recent years, applications of science and technology have expanded rapidly, increasing the education and training required of workers. This has made vocational training programs more attractive as an educational option. The new technologies require well-trained workers to carry out both standardized and specialized procedures, and whose training foundations have given them the capacity to keep pace with continuing technology demands.

The Florida Department of Education shares with business and industry the determination to provide opportunities for upward mobility to as many Floridians as possible. Vocational training programs can keep pace with the demands of new industrial patterns and can provide the opportunity for many of our citizens to gain financial stability and an improved sense of self worth. Therefore, it is necessary to create exemplary vocational programs and to make those programs consistent throughout the state.

This Program Guide identifies primary concerns that should be considered in the organization, operation and evaluation of a vocational education program. It has been developed to provide useful information to local school district and community college administrators, instructors, program advisory committees, regional coordinating councils and others charged with the responsibility of offering vocational education programs.

OCCUPATIONAL DESCRIPTION

A principle occupational title is identified for each vocational training program. This title is validated by the United States Department of Labor Dictionary of Occupational Titles (DOT) or other appropriate references. Such references may be the United States Department of Commerce Standard Occupational Classification Manual (SOC), the Occupational Employment Statistics Survey Dictionary (OES), or Vocational Preparation and Occupations (VPO) prepared by the National and State Occupational Information Coordinating Committees. Information obtained from industry advisory committees may also be used to validate the principle occupational title. The job title and code number for this program are listed in the curriculum framework which accompanies this guide.

The United States Department of Labor Dictionary of Occupational Titles (D.O.T.) identifies the job title for this occupational area as follows:

D.O.T. JOB TITLE	D.O.T. CODE
Millwright	638.281-018
Maintenance Mechanic	629.280-010
Machinery Erector	638.261-014

The definition (description) for this job title is taken from the D.O.T. for easy reference.

MILLWRIGHT

Installs machinery and equipment according to layout plans, blueprints and other drawings in industrial establishment, using hoists, lift trucks, handtools and power tools: Reads blueprints and schematic drawings to determine work procedures. Dismantles machines, using hammers, wrenches, crowbars and other handtools. Moves machinery and equipment, using hoists, dollies, rollers and trucks. Assembles and installs equipment, such as shafting, conveyors and tram rails, using handtools and power tools. Constructs foundation for machines, using handtools and building materials, such as wood, cement and steel. Alines machines and equipment, using hoists, jacks, handtools, squares, rules, micrometers and plumb bobs. Assembles machines and bolts, welds, rivets or otherwise fastens them to foundation or other structures, using handtools and power tools. May operate engine lathe to grind, file and turn machine parts to dimensional specifications. May repair and lubricate machines and equipment.

MAINTENANCE MECHANIC

Sets up, repairs and adjusts equipment and machines. Disassembles malfunctioning equipment, using handtools and welds broken parts [WELDER, GAS (welding)], replaces babbitt in bearings [BABBITTER (mach. shop)], or repairs or replaces machine drive belts [BELT REPAIRER (any ind.)] to repair equipment. May install blades on machine rollers and be designated ROLL FILLER (leather mfg.).

MACHINERY ERECTORS

Erects and tests machinery and heavy equipment, such as hydraulic turbines, turbine wheels, jaw stone crushers, industrial surface condensers, flaking machines, valves and mine hoists, according to blueprints and specifications, using handtools, heating equipment and measuring instruments: Positions steel beams to support bedplates of machines and equipment. Levels bedplate and establishes centerline, using straightedge, levels and transit. Signals BRIDGE-OR-GANTRY-CRANE OPERATOR (any ind.) to lower basic assembly unit, such as shaft, shaft casing, frame or housing unit, to bedplate and alines unit to centerline. Lays out mounting holes, using measuring instruments and drills holes with power drill. Bolts parts, such as side and deck plates, jaw plates and journals, to basic assembly unit. Attaches moving parts and subassemblies, such as shafts, rollers, flywheels, runners (water wheels), valves, gates, bearings and bearing supports, to basic assembly unit, using handtools and power tools. Shrink-fits bushings, gas heating equipment. Inserts shims, adjusts tension on nuts and bolts or position parts, using handtools and measuring instruments to set specified clearances between moving and stationary parts. Connects power unit to machines or steam piping to equipment, and tests unit to evaluate its mechanical operation. Replaces defective parts of machine or adjusts clearances and alinement of moving parts. Dismantles machinery and equipment for shipment to installation site.

PROGRAM CONTENT

The Division of Vocational, Adult, and Community Education, as required by State Board of Education **(S.B.E.) Rule 6A-6.0571**, publishes Vocational Education Program Courses Standards annually. This document specifies the minimum program content for the operation of a vocational training program for the occupational titles listed. Each program identified in the Florida Department of Education Course Code Directory is required to establish course standards. The standards for each vocational offering are comprised of two major components: (1) Curriculum Framework and (2) Student Performance Standards.

Curriculum Framework (CF)

The Curriculum Framework specifies the exact course title, course number, levels of instruction, major course content, laboratory activities, special notes, major course concepts and intended outcomes. The program requirements stipulated in the curriculum framework have been approved by the State Board of Education and are the legal bases for delivery of instruction.

Student Performance Standards (SPS)

The Student Performance Standards are a resource list of job-specific competencies. This list is generated and approved by industry experts and becomes the basis for curriculum development in vocational programs. Local school districts and community colleges must, by law, adopt student performance standards for their vocational programs. They may, at their discretion, adopt the list provided or develop their own as long as there is sufficient content to address each intended outcome. A program may provide instruction beyond the minimum specified in the SPS if desired. The decision to do this should be based on local industry needs. However, the minimum must be presented.

The SPS for secondary level programs contain a third component, course structure. This component specifies the number of courses required for program completion and the content of each course. The courses may be taught in any sequence, but the content may not be changed unless approved by the Division of Vocational, Adult, and Community Education.

The curriculum framework and student performance standards are intended for use as a guide, not a teaching tool. Teachers or curriculum development personnel are expected to develop or select complete curriculum materials for their training programs based on the curriculum framework and student performance standards. Each intended outcome and SPS should be thoroughly analyzed for related cognitive and procedural subskills. The curriculum framework and student performance standards are presented in the following pages.

CURRICULUM FRAMEWORK PROGRAM AREA: Industrial

FLORIDA DEPARTMENT OF EDUCATION EFFECTIVE DATE: July, 1991

PROGRAM TITLE: Industrial Machinery Maintenance and Repair

CODE NUMBER: Secondary _______ Postsecondary ETI0450

Florida CIP 0647.030300

SECONDARY SCHOOL CREDITS ____ COLLEGE CREDITS ____ POSTSECONDARY ADULT VOCATIONAL CREDITS ____

APPLICABLE LEVELS(S): __ 7-9 __ 9-12 __ Postsecondary Adult Vocational

__ Postsecondary Vocational X Other 30,31

CERTIFICATION COVERAGE: TEC CONSTR @7 MILLWRIGHT 7 BLDG CONST @ 7

I. MAJOR CONCEPTS/CONTENT: The purpose of this program is to prepare students for employment as millwrights (85123626), maintenance mechanics (629.280-010), machinery erectors (638.261-014), or to provide supplemental training for persons previously or currently employed in these occupations.

The content includes, but is not limited to, communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, metal working skills, welding, basic machine shop functions, troubleshooting techniques, preventative maintenance programs, rigging, equipment installation, and maintenance and repair of a variety of systems found in industrial operations including drive components, piping systems, pumps, hydraulic systems, pneumatic systems, and bearings and seals.

II. LABORATORY ACTIVITIES: Shop or laboratory activities are an integral part of this program and provide instruction in shop practices, rigging, equipment installation, maintenance, troubleshooting and repair of drive systems, pumps, hydraulic and pneumatic systems as well as basic welding and machine shop skills.

III. SPECIAL NOTE: The Vocational Industrial Clubs of America, Inc., is an appropriate vocational student organization for providing leadership training experiences and reinforcing specific vocational skills. When provided, these activities are considered an integral part of this program.

The cooperative method of instruction may be utilized for this program. When the cooperative method is offered, the following is required for each student: a training plan, signed by the student, teacher and employer which includes instructional objectives and a list of on-the-job and in-school learning experiences; and a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal. The student must receive compensation for work performed.

In accordance with Section 233.0695 F.S., the minimum basic skills grade level required for this postsecondary adult vocational program is: Mathematics 8.0, Language 8.0. This grade level number corresponds to a grade equivalent score obtained on a state designated basic skills examination.

The typical length of this program for the average achieving student is 1800 hours.

VI. INTENDED OUTCOMES: After successfully completing this program, the student will be able to:

01. Read blueprints and schematics.
02. Apply mathematics, physics and metallurgy skills.
03. Utilize and maintain hand tools.
04. Utilize and maintain portable power tools.
05. Perform gas and arc welding procedures.
06. Demonstrate knowledge of basic electricity and electronics.
07. Install and maintain drive components.
08. Perform pump maintenance and repair.
09. Maintain piping and tubing systems.
10. Maintain and repair hydraulic system components.
11. Troubleshoot hydraulic systems.
12. Maintain reciprocating, positive displacement, rotary and dynamic air compressors.
13. Troubleshoot pneumatic systems.
14. Maintain and troubleshoot fluid drive systems.
15. Demonstrate a knowledge of the operation of industrial pollution control systems.
16. Perform rigging functions.
17. Install and remove machinery.
18. Perform machine shop operations.
19. Handle and apply lubricants.
20. Demonstrate employability skills.
21. Demonstrate an understanding of entrepreneurship.

STUDENT PERFORMANCE STANDARDS EFFECTIVE DATE: July, 1991

PROGRAM AREA: Industrial Education SECONDARY NUMBER: _______

PROGRAM TITLE: Industrial Machinery Maintenance and Repair POSTSECONDARY NUMBER ETI0450

01.0 READ BLUEPRINTS AND SCHEMATICS--The student will be able to:

01.01 Explain the purpose of blueprints.
01.02 Examine and interpret machine parts and machine drawings.
01.03 Read and interpret machine assembly drawings.
01.04 Read and interpret building drawings.
01.05 Read and interpret schematics and symbols.
01.06 Read and interpret level electrical diagrams.
01.07 Read a piping schematic.
01.08 Identify fluid power system component symbols and interpret diagrams.

02.0 APPLY MATHEMATICS, PHYSICS AND METALLURGY SKILLS--The student will be able to:

02.01 Add, subtract, multiply and divide positive and negative numbers.
02.02 Add, subtract, multiply and divide fractions.
02.03 Change mixed numbers to decimals and vice versa.
02.04 Develop and interpret ratios.
02.05 Apply entry level geometric functions.
02.06 Solve entry level algebraic equations.
02.07 Apply metric and linear measurement.
02.08 Describe mechanical and chemical properties of ferrous and non-ferrous metals.
02.09 Describe the properties and uses of toxic and flammable materials.

03.0 UTILIZE AND MAINTAIN HAND TOOLS--The student will be able to:

03.01 Demonstrate safe use of hand tools.
03.02 Utilize measuring devices.
03.03 Utilize wrenches and screwdrivers.
03.04 Utilize pipefitting tools.
03.05 Utilize sheetmetal tools.
03.06 Demonstrate the use of ropes, slings, pulleys and block and tackle.

04.0 UTILIZE AND MAINTAIN PORTABLE POWER TOOLS--The student will be able to:

04.01 Demonstrate safe use of portable power tools.
04.02 Utilize and maintain light-duty and heavy-duty drills.
04.03 Utilize and maintain electric hammers.
04.04 Utilize and maintain pneumatic drills and hammers.
04.05 Utilize and maintain power screwdrivers, nut runners.
04.06 Utilize and maintain linear motion saws.
04.07 Utilize and maintain circular saws.
04.08 Utilize and maintain belt, pad and disc sanders.
04.09 Utilize and maintain grinders and shears.

05.0 PERFORM GAS AND ARC WELDING PROCEDURES--The student will be able to:

05.01 Demonstrate safety procedures for performing gas and arc welding.
05.02 Identify components of oxyfuel rig.
05.03 Set up and shut down oxyfuel rig.
05.04 Weld beads in flat position.
05.05 Weld outside corner joint using a filler rod.
05.06 Cut metal of various thicknesses.
05.07 Weld beads in flat position using E-6010 and E-7018 electrodes.
05.08 Weld beads in horizontal position using E-6010 and E-7018 electrodes.
05.09 Weld beads in overhead position using E-6010 and E-7018 electrodes.
05.10 Solder and braze metals.

06.0 DEMONSTRATE KNOWLEDGE OF BASIC ELECTRICITY AND ELECTRONICS--The student will be able to:

06.01 Define electrical/electronic terms.
06.02 Explain the theory and application of magnetism.
06.03 Explain Ohm's Law.
06.04 Describe DC and AC circuits.
06.05 Disconnect and reconnect electric motors.
06.06 Demonstrate an entry level understanding of electrical control equipment.

07.0 INSTALL AND MAINTAIN DRIVE COMPONENTS--The student will be able to:

07.01 Demonstrate safety procedures for installing and maintaining drive components.
07.02 Identify types of bearings.
07.03 Remove, inspect and/or replace bearings.
07.04 Remove and replace seals.
07.05 Perform shaft alignment.
07.06 Identify types of belts.
07.07 Identify types of chains.
07.08 Perform tension adjustments on belt and chain drives.
07.09 Troubleshoot belts and chain drives.
07.10 Remove, replace and align couplings.
07.11 Identify types of gears.
07.12 Remove/replace gears.
07.13 Adjust gear backlash.
07.14 Troubleshoot gear drives.
07.15 Disassemble, inspect, reassemble and adjust clutches.
07.16 Identify types of variable speed drives.
07.17 Troubleshoot variable speed drives.
07.18 Identify types of cams and link mechanisms.
07.19 Troubleshoot cam and link mechanism problems.

08.0 PERFORM PUMP MAINTENANCE AND REPAIR--The student will be able to:

08.01 Demonstrate safety procedures for performing pump maintenance.
08.02 Determine pump capacity and system requirements (entry level).
08.03 Perform pump maintenance.

08.04 Identify packing and seal requirements.
08.05 Explain operating principles of centrifugal, propeller and turbine rotary, reciprocating and metering pumps.
08.06 Disassemble and reassemble a pump.

09.0 MAINTAIN PIPING AND TUBING--The student will be able to:

09.01 Identify components of a piping system.
09.02 Explain maintenance considerations of metallic and non-metallic piping systems.
09.03 Join copper tubing.
09.04 Join common fittings.
09.05 Join metallic pipe.
09.06 Join plastic pipe.
09.07 Explain valve operation and maintenance.
09.08 Explain importance of strainers, filters and traps in piping systems.

10.0 MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS--The student will be able to:

10.01 Explain safety procedures for installing hydraulic lines.
10.02 Explain Pascal's Law.
10.03 Explain Bernoulli's Principle.
10.04 Explain how heat and pressure relate to power and transmission.
10.05 Describe physical and chemical properties of a fluid.
10.06 Install and maintain a contaminate removal system.
10.07 Determine reservoir requirements.
10.08 Classify and select pumps for specific applications.
10.09 Compute hose requirements.
10.10 Install hydraulic lines.
10.11 Select and install control valves.

11.0 TROUBLESHOOT HYDRAULIC SYSTEMS--The student will be able to:

11.01 Explain safety procedures for troubleshooting hydraulic systems.
11.02 Read a hydraulic schematic.
11.03 Install hydraulic components.
11.04 Connect electricity controlled valves.
11.05 Explain hydraulic system troubleshooting techniques.
11.06 Repair and replace valves.
11.07 Repair and replace cylinders.
11.08 Repair and replace pumps and motors.
11.09 Cut, flare and bend tubing.

12.0 MAINTAIN RECIPROCATING, POSITIVE DISPLACEMENT, ROTARY AND DYNAMIC AIR COMPRESSORS--The student will be able to:

12.01 Relate force, weight, mass and density to a pneumatic system.
12.02 Explain the operation of reciprocating compressors.
12.03 Explain the operation of positive-displacement rotary compressors.
12.04 Explain primary and secondary air treatment.
12.05 Explain the operation of valves, cylinders and motors.

13.0 TROUBLESHOOT PNEUMATIC SYSTEMS--The student will be able to:

13.01 Explain safety procedures for troubleshooting pneumatic systems.
13.02 Identify common schematic symbols and diagrams.
13.03 Diagram an air supply system.
13.04 Install system components.
13.05 Explain system maintenance techniques.
13.06 Explain proper troubleshooting procedures.
13.07 Troubleshoot air compressors.
13.08 Troubleshoot control valves.
13.09 Troubleshoot, repair and install control valves.
13.10 Troubleshoot air motors.

14.0 MAINTAIN AND TROUBLESHOOT FLUID DRIVE SYSTEMS--The student will be able to:

14.01 Explain safety procedures for maintaining and troubleshooting fluid drive systems.
14.02 Install adjustable speed drives.
14.03 Troubleshoot adjustable speed drives.
14.04 Explain operation of fluid couplings.
14.05 Install fluid couplings.
14.06 Install torque converters.
14.07 Perform preventative maintenance.
14.08 Select adequate substitute bearings when required to restore motor operation.
14.09 Align motor shafts, couplings, pulleys, drive sheaves and guards on both parallel and in-line shafts.
14.10 Apply "dynamic" magnetic/mechanical braking device to a motor.
14.11 Mount equipment.

15.0 DEMONSTRATE A KNOWLEDGE OF THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYSTEMS--The student will be able to:

15.01 Explain the operation of air pollution control systems.
15.02 Explain the operation of water pollution control systems.
15.03 Explain the operation of solid waste pollution control systems.
15.04 Explain the operation of noise pollution control systems.
15.05 Explain the basic philosophy of "right to know" legislation.

16.0 PERFORM RIGGING FUNCTIONS--The student will be able to:

16.01 Demonstrate safety procedures for performing rigging operations.
16.02 Identify and inspect fiber and wire rope.
16.03 Tie knots and hitches.
16.04 Identify and use components of rigging hardware.
16.05 Perform rigging operations.

17.0 INSTALL AND REMOVE MACHINERY--The student will be able to:

17.01 Identify safety procedures for installing and removing machinery.
17.02 Identify equipment required for machine installation/removal.
17.03 Prepare area for machine installation per manufacturer's specifications.
17.04 Rig, lift and transport machinery to installation site.
17.05 Align machinery using wire-line, transit, dial indicators, computer and laser alignment devices.

17.06 Position and secure machinery on foundation.
17.07 Level machinery and install balance/vibration dampeners.
17.08 Install electrical hookups to machinery.
17.09 Install air/hydraulic hookups to machinery.
17.10 Perform assigned machine retrofit per manufacturer's specifications.
17.11 Perform assigned machine removal and transport per specification requirements.
17.12 Demonstrate proficiency in vibration detection.

18.0 PERFORM MACHINE SHOP OPERATIONS--The student will be able to:

18.01 Demonstrate safety in performing machine shop operations.
18.02 Drill holes using drill press.
18.03 Identify types of cutting tools.
18.04 Bore a hole to a specified size.
18.05 Turn an external V-thread.
18.06 Identify different types of work holding devices.
18.07 Prepare metal for finishing.

19.0 HANDLE AND APPLY LUBRICANTS--The student will be able to:

19.01 Explain the functions of lubrication.
19.02 Explain the properties of oil lubricants and factors determining the selection of lubricants.
19.03 Identify the types, advantage and functions of lubricant additives.
19.04 Explain the types of circulating oils and their purposes.
19.05 Identify grease application.
19.06 Identify lubricating systems and methods.
19.07 Explain lubricant storage and handling methods.
19.08 Lubricate a piece of industrial equipment.

20.0 DEMONSTRATE EMPLOYABILITY SKILLS--The student will be able to:

20.01 Conduct a job search.
20.02 Secure information about a job.
20.03 Identify documents that may be required when applying for a job.
20.04 Complete a job application form correctly.
20.05 Demonstrate competence in job interview techniques.
20.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons.
20.07 Identify acceptable work habits.
20.08 Demonstrate knowledge of how to make job changes appropriately.
20.09 Demonstrate acceptable employee health habits.
20.10 Demonstrate a knowledge of the "Florida Right-to-Know Law" as recorded in Florida Statutes Chapter 442.

21.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP--The student will be able to:

21.01 Define entrepreneurship.
21.02 Describe the importance of entrepreneurship to the American economy.
21.03 List the advantages and disadvantages of business ownership.
21.04 Identify the risks involved in ownership of a business.
21.05 Identify the necessary personal characteristics of a successful entrepreneur.
21.06 Identify the business skills needed to operate a small business efficiently and effectively.
21.07 Demonstrate knowledge of state licensing requirements.

PROGRAM IMPLEMENTATION

It is the teacher's responsibility to ensure that students learn how to competently perform the tasks specified in the course objectives. Therefore, the teacher must lead the students through the learning experiences in a course, motivate students, act as a role model for students, and at times, function as a guidance counselor and placement coordinator. This leadership role requires the teacher to participate in many of the activities required for program implementation. The teacher must select the methods of instruction that best apply to students' ability levels, measure student achievement and provide feedback. Key factors that must be considered when implementing this program are addressed below.

TEACHER CHARACTERISTICS

Subject Knowledge

The teacher must be a subject matter expert who is able to implement sound instructional methods and evaluate student performance. He/she must have significant work experience in the industry/vocational field and be able to communicate that knowledge to the students.

Instructional Delivery

The teacher's role in the learning process is to motivate and lead the student as well as impart subject matter knowledge. In order to maximize student learning, the use of a variety of instructional methods is encouraged. Because teaching styles vary greatly, teachers are highly encouraged to "pick and choose" from various methods or to combine methods for maximum benefit to students. Some of the more traditional methods used are lecture, demonstration and small group instruction. Other teaching methods which are suggested for further exploration include individualized self-paced, open-exit/open-entry, contract, computer based and competency based instruction. The focus of Competency Based Vocational Education (CBVE) is to ensure that each student can competently perform tasks specified before progressing to more complex skills.

CONVENTIONAL INSTRUCTIONAL METHODS

A vocational program may require a portion of the instruction to be presented in a standard lecture or controlled demonstration format. These methods of instruction can be easily combined with instructor controlled step-by-step practical exercises. Some instructional activities may dictate that this instructional approach be used to introduce students to hazardous equipment often utilized in vocational training. In most situations, students should be required to perform specified activities to achieve maximum skill competency. If mastery of a task is required, competency based education methods may be more appropriate. However, if the training activity involves an orientation or a seldom performed, non-essential task, conventional instructional methods may be more effective. Teachers are encouraged to use a variety of instructional methods to best meet instructional objectives.

Instructional Development

Teachers often must develop and select their own teaching and curriculum materials. In developing a comprehensive curriculum, instructional objectives based upon both the performance and cognitive domain must be included. When developing curriculum materials, teachers must use the curriculum framework (CF) and student performance standards (SPS) contained in this program guide as a basis. These materials delineate minimim program content which must be presented for an approved vocational training program. However, they are not intended for use as a comprehensive curriculum. Be certain not to adapt the curriculum to available materials, but select only those materials which can be adapted to the curriculum.

Instructional Measurement

Teachers must select testing methods that support the instructional delivery system used. Teachers must be competent to develop, administer and evaluate written and performance type tests.

Student Admissions Criteria

Providing the student the opportunity to successfully complete a vocational education program, in any institution, should be the primary concern of the instructional effort. Therefore, it is very important to direct planning and effort into identifying and selecting students with excellent potential for success in the educational program and in the occupation. The school's primary task is to prepare people for fulltime, entry-level positions as technicians or, in the case of those with more experience, as managers.

The Course Code Directory, specifies grade levels at which occupational programs are offered. Specific student admissions criteria which are required by the State and local educational agencies for the Industrial Machinery Maintenance Repair training program are illustrated as follows.

SPECIFIC ADMISSIONS CRITERIA

Minimum Age:	As required by state and local policy
Physical Requirements:	None
Special Requirements:	Students are required to take the Test Adult Basic Education (TABE) Test and score tenth grade level or above. Those scoring below this level meet with three members of the Craft Committee and determine their options for enrollment. Based on student interest and abilities the Craft Committee may recommend the student enroll and complete one or more sessions in Individualized Manpower Training Stations (IMTS).
Minimum Basic Skills Math Level:	* 8.0
Minimum Basic Skills Language Level:	* 8.0

* This grade level requirement is specified in the Curriculum Framework and is applicable to postsecondary level programs of 450 hours or more only. There is no minimum basic skill requirement for secondary programs.

THE STUDENT PROFILE

Developing a student profile is an important step in program implementation. Attention should focus on student characteristics that can be remediated within a training program, but could create serious impediments to success in the vocational field. Typical of these would be deficiencies in communication and mathematical skills. The basic skill levels can be measured by testing. Test results can then be used to direct the student to more suitable training which matches his or her skill level, or to determine supplemental training which may be required to increase chances for student success.

High school and postsecondary vocational students can be admitted to a vocational program upon request if they meet any specified prerequisites, such as physical or basic skill requirements. Training programs should be accessible to as many students as possible. Training programs are designed to prepare students for employment upon graduation, or serve as prerequisite to a postsecondary program.

The community college can be more selective and establish stringent admission standards. This may be done by assessing applicants or by recruiting potential students who meet the established prerequisite requirements of the training. The program advisory committee can design a profile of the potentially successful student. The profile should contain a list of qualities, traits and aptitudes that will indicate a higher potential for student success. Acceptable levels for these traits must also be determined. For example, the qualities deserving highest attention, mechanical ability and cognitive aptitude, are those which the educational program itself will not likely be able to influence, although these traits should have considerable weight in establishing the basic profile. Deficiencies in mathematical or communication skills may lend themselves to improvement through related instruction while the student is enrolled in the program. The following example illustrates specific qualities to consider when establishing the student profile:

Mechanic/Technician--Service

- Knowledge of basic tools and equipment used by mechanics/technicians
- Ability to analyze and solve mechanical and technical problems
- Ability to interpret written mechanical/technical materials
- Ability to interpret mechanical/technical drawings
- Mechanical dexterity

Mechanic/Technical Service Management

- Basic application of service
- Business skills
- Ability to work with people
- Communication skills
- Leadership

QUALIFYING AND PRETESTING

Assessing potential students for vocational programs is an integral part of the recruiting process since considerable amounts of time and money will be spent on students entering training. Recruiters must have a good idea of the candidate's basic aptitude. Whoever guides the candidate to the program needs to have knowledge of the student's interests, abilities and experience. These can be measured by a variety of assessment methods, which should be performed upon program entry. The assessment can help determine extent and level of training each individual should receive.

The minimim basic skills requirement for mathematics and language skills is specified on the curriculum framework. Assessment should determine the level at which the student can read, write, calculate mathematics and understand the English language. It is appropriate for the program advisory committee and the school to develop some selection criteria based on minimum skill levels. These criteria should remain flexible in order to maximize educational opportunity for all applicants. Additionally, vocational educators must make every effort to serve the variety of "special needs" students and to eliminate sex-bias and stereotyping in all occupational areas.

ADVISORY COMMITTEE

It is imperative that representatives of industry be organized into an advisory committee. Constantly changing technological demands of our society will continue to stimulate changing industrial patterns. Therefore, effective use of program advisory committees is vital to the successful implementation of vocational training programs. Advisory committees provide expert technical advice which is not easily obtainable elsewhere, offer external support of policies and have tremendous public relations potential.

The most effective advisory committees are those whose members have mutual respect for each other's abilities and vested interest in the training program because of their need for trained workers. The program advisory committee is also one of the most effective means of facilitating placement. Its role can be:

- To contact local industry and encourage them to use the school's placement office as a means of filling jobs
- To develop an effective procedure for interviewing and evaluating potential employees suggested by the school
- To assist in gathering accurate and current job information as it becomes available

COUNSELING AND GUIDANCE

Counseling of students serves two purposes. It guides the student into the program and it supports enrolled students on a continuing basis throughout the program. Much day-to-day counseling will be the responsibility of the teacher. The teacher has the most contact with the student and is in a position to detect and correct a problem. Each student will encounter new problems as the program develops. The teacher's job is to work with the student to help identify problems and then strive for solutions. The teacher will provide much of the counseling that focuses on trade knowledge and skills.

The professional counselor cannot be expected to have the subject matter expertise of the primary teacher. The counselor, however, can focus on the student's needs related to other issues such as personal growth, interests and attitudes. The ideal situation will provide at least one counselor with current knowledge of industry standards for career counseling. A useful tool which should be used in the counseling process is the Career Merit Achievement Plan (Career MAP) which presents minimum instructional content keyed to student performance standards. Career MAPs are available for each industrial program area, and can be used to document student achievement, isolate student interests, talents and weaknesses. They are also useful for placement purposes. Information on Career MAPs may be obtained by contacting the Department of Education, Division of Vocational, Adult, and Community Education, (904) 488-0484.

STUDENT PLACEMENT

Implementing an effective placement system is integral to developing a successful vocational training program. **S.B.E. Rule 229.551 (3)(g)** requires 70 percent placement of students who have completed a vocational training program. Although placement is not always a problem, as with students already working in a related occupation, the placement program should place emphasis upon students who are seeking entry-level employment since these students have little or no experience with industry.

The task of the placement program is to locate job openings in the community. The placement coordinator or teacher must know each student's personal aims and interests in addition to the information stated on the achievement record. In many cases, teachers are the best source to match students to job openings because of their contacts with the industry advisory committee. Input concerning employment openings must come from individual business establishments in the community. The placement coordinator should introduce a student to as many suitable job openings as possible. Conversely, employers can then be expected to interview as many qualified candidates as possible.

Cooperative Education

COOPERATIVE EDUCATION APPLICABILITY

Normally, a student will complete the entire program as a full-time student before obtaining employment as a maintenance mechanic. However, there may be situations where a student could be allowed to complete part of the program while employed as a maintenance mechanic. At this time it is appropriate for the student to enroll in industrial cooperative education (ICE). Guidelines for this training plan are provided in the "Industrial Cooperative Education Program Guide," published by the Division of Vocational, Adult, and Community Education, Order # IE 508 BK 87.

Industrial cooperative education is a method of instruction designed to prepare students for jobs in the community. This method is a joint effort between the school and the business community. Student trainees receive a combination of instruction in the classroom and related on-the-job training through employment. Learning experiences are jointly planned and supervised by the teacher and the employer. Cooperative education is relevant to the needs of the student preparing for a work role, and will help the student to achieve success and personal satisfaction as the transition is made from school to the constantly changing world of work.

Cooperative education is defined in the Federal Register, Volume 39, number 143, Vocational Education, Section 102.96, as a program ". . . to prepare students for employment, through: (a) providing meaningful work experiences combined with formal education enabling students to acquire knowledge, skills, and appropriate attitudes, (b) removing the artificial barriers which separate work and education, (c) involving educators with employers, creating interaction whereby the needs and problems of both are made known, thereby making it possible for occupational curricula to be revised to reflect current needs in various occupations . . . ."

PURPOSE

Cooperative Education is for persons who, through written cooperative arrangements between the school and employers, receive instruction, including required academic courses and related instruction by alternation of study in school with a job in any industrial occupational field. These two experiences must be planned and supervised by the school and employers so that each contributes to the student's education and employability. Work periods and school attendance may be on alternative half days, full days, weeks or other periods of time to fulfill objectives of the cooperative education program.

GOALS AND OBJECTIVES

The primary goal of the cooperative method of vocational education is to prepare skilled, responsible individuals who can assume a productive role in the community. Specific objectives to meet the primary goal are:

- To prepare individuals for employment, adjustment and advancement in specified occupations or occupational areas (primary objective)
- To provide an understanding of the contribution of work to the social and economic welfare of our nation
- To provide students with an understanding and appreciation of the American free enterprise system
- To foster an awareness of the civic, social and moral responsibilities of individuals to society
- To stimulate students' interest in their chosen occupational fields and provide an understanding of the opportunities in each field
- To provide training that results in increased efficiency in performing job tasks
- To provide curriculum which is sensitive and adaptable to changes in occupational practices and procedures as they are affected by societal, economic, technical and educational developments
- To strive to develop a greater appreciation of the value of specifically trained personnel among employers, employees and consumers
- To reinforce skills learned in the school laboratory
- To provide experiences on tools and equipment not available in the school laboratory
- To supplement and broaden the school curriculum into areas not otherwise available

Student Organization Participation

Vocational student organizations operate pursuant to federal and state laws, which authorize them as viable components of vocational education programs. According to federal regulations, the vocational education program of instruction may include activities of vocational student organizations which are an integral part of the vocational instruction offered and which are supervised by vocational education personnel. The **S.B.E.** Rules authorize vocational student organizations as an integral part of the vocational education program as stated in **S.B.E. 6A-6.064 (7)** and **6A-6.065 (8).**

VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)

VICA is an organization for secondary or postsecondary students enrolled in trade and industrial education programs in high schools, area vocational technical centers and junior and community colleges. It is the only national and international organization for trade and industrial students. The organization is designed to expand and enrich opportunities for leadership, social awareness and civic responsibility in vocational students.

Students who participate in VICA activities are often better prepared for the world of work. They acquire knowledge of the many opportunities available in their chosen careers and become aware of the value of their contributions to society. They are also given opportunities to develop and utilize their talents and abilities in ways that otherwise would not be available to them.

BENEFITS OF VICA MEMBERSHIP FOR THE STUDENT

Membership in VICA offers the student the opportunity for growth and development in the following areas:

> **School and Community Service Activities** Students in VICA become involved in various school and/or community services. These may include clothing or food collections for the needy, donation of time and service to the elderly and participation in fund raisers or similar activities.
>
> **Social Interaction with Fellow Students** Activities are also available that offer students time for relaxation and fun. Social activities of this type may be held on a regular basis. They might be held on the school campus during school hours, or off campus after school. More formal functions would include end of the year award banquets or industry/employer appreciation dinner banquets.
>
> **Competition in Skill and Leadership Contests** VICA offers various contests in all the skill and leadership areas it serves. Often, teachers identify talented students who represent their school in regional competitions. However, any student member of VICA may compete. Instructors should conduct planned contests within their trade areas. This also pertains to leadership areas. First and second place regional winners then move on to the state level contest. The state winners then compete at the national level of the United States Skill Olympics.

INSTRUCTIONAL RESOURCES

STUDENT REFERENCE MATERIALS

Necessary instructional texts or pertinent material should be available for each student to satisfy training objectives. When textbooks are used, the copyright date should be as current as possible.

SERVICE MANUALS

Manuals with current manufacturer's service procedures and specifications should be available. These manuals must be located where students can use them while working in the shop area.

PERIODICALS

Current general and technical magazines and newspapers should be available for student and instructor use.

The following list of suggested resources is organized under each outcome shown in the curriculum framework. These resources have been recommended by instructors and program administrators.

01.0 READ BLUEPRINTS AND SCHEMATICS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Electrical Print Reading	INDUSTRIAL TRAINING CORPORATION	module/video
Mechanical Print Reading	INDUSTRIAL TRAINING CORPORATION	module/video
Blueprint Reading for Industry Walter C. Brown ISBN 0-87006-559-9	GOODHEART-WILLCOX COMPANY, INC.	text
Drafting Paul Wallach ISBN 0-02-829600-1	BENNETT AND McKNIGHT - GLENCOE PUBLISHING	text
Millwrights and Mechanics Guide ISBN 0-672-23373-8	MACMILLAN COMPANY	text
Print Reading for the Machine Trades Wilfred B. Pouler ISBN 0-538-33350-2	SOUTHWESTERN PUBLISHING	text
Millwright Instructional Materials, Blueprints and Schematics	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit
Reading Blueprints	TPC TRAINING SYSTEMS	trainer/kit
Schematics and Symbols	TPC TRAINING SYSTEMS	trainer/kit

02.0 APPLY MATHEMATICS, PHYSICS AND METALLURGY SKILLS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Practical Problems in Mathematics for Machinists Hoffman ISBN 08-273-25592	DELMAR PUBLISHING	text
Basic Shop Math	TPC TRAINING SYSTEMS	trainer/kit
Millwright Instruction Materials, Mathematics, Physics and Metallurgy Skills	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit
Understanding Basic Mechanics	TPC TRAINING SYSTEMS	trainer/kit

03.0 UTILIZE AND MAINTAIN HAND TOOLS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Decimal Equivalent and Tap Drill Chart	L. S. STARRETT COMPANY	chart
Educational Charts Cat. No. 1702	L. S. STARRETT COMPANY	chart
Metric Conversion Chart	L. S. STARRETT COMPANY	chart
Micrometer Chart	L. S. STARRETT COMPANY	chart
Tool Chart	L. S. STARRETT COMPANY	chart
Hand Tools	INDUSTRIAL TRAINING CORPORATION	module/video

Measuring Instruments	INDUSTRIAL TRAINING CORPORATION	module/video
Shop Tools	JOHN DEERE SERVICE TRAINING	text
Starrett General Catalog No. 28	L. S. STARRETT COMPANY	text
The Tools and Rules for Precision Measurement Bulletin No. 1211	L. S. STARRETT COMPANY	text
Millwright Instructional Materials, Hand Tools	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit
Starrett Tools and Rules (for Precision Measurement) ST-TR386	L. S. STARRETT COMPANY	video

04.0 UTILIZE AND MAINTAIN PORTABLE POWER TOOLS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Millwright Instructional Materials, Portable Power Tools	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit
Portable Power Tools	TPC TRAINING SYSTEMS	trainer/kit

05.0 PERFORM GAS AND ARC WELDING PROCEDURES

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Brazing and Braze Welding	INDUSTRIAL TRAINING CORPORATION	module/video
General Techniques and Safety Practices	INDUSTRIAL TRAINING CORPORATION	module/video
Oxygen-Fuel Gas Cutting	INDUSTRIAL TRAINING CORPORATION	module/video
Principles and Metallurgy	INDUSTRIAL TRAINING CORPORATION	module/video
Shielded Metal-Arc Welding	INDUSTRIAL TRAINING CORPORATION	module/video
Millwrights and Mechanics Guide ISBN 0-672-23373-8	MACMILLAN COMPANY	text
New Lessons in Arc Welding	LINCOLN ELECTRIC COMPANY	text
The Oxy-Acetylene Handbook	UNION CARBIDE CORPORATION, LINDE DIVISION	text

06.0 DEMONSTRATE KNOWLEDGE OF BASIC ELECTRICITY AND ELECTRONICS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
AC/DC Theory	INDUSTRIAL TRAINING CORPORATION	module/video
Safety Practices	INDUSTRIAL TRAINING CORPORATION	module/video

Test Instruments	INDUSTRIAL TRAINING CORPORATION	module/video
A Stitch in Time (Training Program for Electrical Insulation Testing)	BIDDLE INSTRUMENTS	slides/ cassette
Industrial Electricity Rex Miller ISBN 0-02-664730-3	BENNETT AND McKNIGHT - GLENCOE PUBLISHING	text
A-C Control Equipment	TPC TRAINING SYSTEMS	trainer/kit
Electrical Protective Devices	TPC TRAINING SYSTEMS	trainer/kit
Understanding Basic Electricity and Electronics	TPC TRAINING SYSTEMS	trainer/kit

07.0 INSTALL AND MAINTAIN DRIVE COMPONENTS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Bearings and Lubrication	INDUSTRIAL TRAINING CORPORATION	module/video
Gear Boxes	INDUSTRIAL TRAINING CORPORATION	module/video
Mechanical Drives, Couplings, and Alignment	INDUSTRIAL TRAINING CORPORATION	module/video
Bearing Installation and Maintenance Guide	SKF INDUSTRIES, INC., BEARING DIVISION	text
Bearing Manual Cyclopedia (Volumes 1 & 2)	INDUSTRIAL INFORMATION HEADQUARTERS, INC.	text
Belts and Chains ISBN 0-86691-011-5	JOHN DEERE SERVICE TRAINING	text

CR Seals Handbook	CR INDUSTRIES	text
Eaton Power Transmission Products	EATON CORPORATION	text
Falk Standard Product Catalog	FALK CORPORATION	text
Millwrights and Mechanics Guide ISBN 0-672-23373-8	MACMILLAN COMPANY	text
National Oil Seals Master Interchange	FEDERAL-MOGUL CORPORATION	text
SKF Product Service Guide	SKF INDUSTRIES, INC., BEARING DIVISION	text
Shaft Seal Application Guide	CR INDUSTRIES	text
The Speed Reducer Book	WINSMITH, DIVISION OF UMC INDUSTRIES, INC.	text
Waldes Truarc Technical Manual	WALDES TRUARC, INC.	text
Bearings	TPC TRAINING SYSTEMS	trainer/kit
Drive Components	TPC TRAINING SYSTEMS	trainer/kit
Millwright Instructional Materials, Drive Components	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit

08.0 PERFORM PUMP MAINTENANCE AND REPAIR

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Centrifugal Pump Maintenance	INDUSTRIAL TRAINING CORPORATION	module/video

Pump Operations - Centrifugal Pumps	INDUSTRIAL TRAINING CORPORATION	module/video
Specialized Centrifugal Pumps	INDUSTRIAL TRAINING CORPORATION	module/video
Troubleshooting Centrifugal Pumps	INDUSTRIAL TRAINING CORPORATION	module/video
Troubleshooting Positive Displacement Pumps	INDUSTRIAL TRAINING CORPORATION	module/video
Fairbanks Morse Centrifugal Pump Catalog	FAIRBANKS MORSE PUMP CORPORATION	text
Goulds Pumps Installation, Operation and Maintenance Instructions 8789-EL	GOULDS PUMPS, INC.	text
Installation, Operation, Maintenance (of 3102 series Centrifugal Pumps)	HOUDAILLE INDUSTRIES, INC., WARREN PUMPS DIVISION	text
Millwrights and Mechanics Guide ISBN 0-672-23373-8	MACMILLAN COMPANY	text
Pump Care Manual 395-EL	GOULDS PUMPS, INC.	text
Viking Pump Product Catalog	HOUDAILLE INDUSTRIES, INC., VIKING PUMP DIVISION	text
Millwright Instructional Materials, Pump Maintenance and Repair	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit
Pumps	TPC TRAINING SYSTEMS	trainer/kit

09.0 MAINTAIN PIPING AND TUBING

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Advanced Pipefitting	INDUSTRIAL TRAINING CORPORATION	module/video
Packing and Seals	INDUSTRIAL TRAINING CORPORATION	module/video
Piping	INDUSTRIAL TRAINING CORPORATION	module/video
Modern Plumbing E. Keith Blankenbaker ISBN 0-87006-325-1	GOODHEART-WILLCOX COMPANY, INC.	text
Piping Systems	TPC TRAINING SYSTEMS	trainer/kit

10.0 MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Industrial Hydraulics Manual (with 35mm slides) 935100-A, 935100-S	VICKERS, INC., TECHNICAL TRAINING CENTER	module/ slides
Actuators	INDUSTRIAL TRAINING CORPORATION	module/video
Directional and Flow Controls	INDUSTRIAL TRAINING CORPORATION	module/video
Electro Hydraulic Servo Systems	INDUSTRIAL TRAINING CORPORATION	module/video
Fluids, Filters and Reservoirs	INDUSTRIAL TRAINING CORPORATION	module/video

Hydraulic Pumps, Pumping Principles and Accumulators	INDUSTRIAL TRAINING CORPORATION	module/video
Introduction to Hydraulic Systems	INDUSTRIAL TRAINING CORPORATION	module/video
Pressure Controls	INDUSTRIAL TRAINING CORPORATION	module/video
Variable Volume Hydraulic Pumps	INDUSTRIAL TRAINING CORPORATION	module/video
Practical Hydraulics (Booklet)	VICKERS, INC., TECHNICAL TRAINING CENTER	text
Weatherhead Service Guide (Understanding Hose and Fittings)	DANA CORPORATION	text
Basic Hydraulics	TPC TRAINING SYSTEMS	trainer/kit

11.0 TROUBLESHOOT HYDRAULIC SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Hydraulic System Troubleshooting	INDUSTRIAL TRAINING CORPORATION	module/video

12.0 MAINTAIN RECIPROCATING, POSITIVE DISPLACEMENT, ROTARY AND DYNAMIC AIR COMPRESSORS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Air Compressors and Blowers	INDUSTRIAL TRAINING CORPORATION	module/video
Centrifugal Air Compressors	INDUSTRIAL TRAINING CORPORATION	module/video

Reciprocating Air Compressor Operations	INDUSTRIAL TRAINING CORPORATION	module/video
Millwrights and Mechanics Guide ISBN 0-672-23373-8	MACMILLAN COMPANY	text

13.0 TROUBLESHOOT PNEUMATIC SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Weatherhead Pneumatics Catalog	DANA CORPORATION	text
Basic Pneumatics	TPC TRAINING SYSTEMS	trainer/kit
Industrial Pneumatic Technology ISBN 1-55769-016-2	PARKER HANNIFIN CORPORATION	trainer/kit

14.0 MAINTAIN AND TROUBLESHOOT FLUID DRIVE SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
DI/Dynacorp Incorporated General Products Catalog	DI/DYNACORP, INC.	text
Dodge Engineering Catalog	RELIANCE ELECTRIC COMPANY, DODGE MANUFACTURING DIVISION	text
Link-Belt PIV Variable Speed Drives	LINK-BELT DRIVE DIVISION	text
Link-Belt SFD Silicone Fluid Drives	LINK-BELT DRIVE DIVISION	text

15.0 DEMONSTRATE A KNOWLEDGE OF THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Material Safety Data Sheets	FLORIDA POWER CORPORATION	chart
Environmental Protection Systems	NUS TRAINING CORPORATION	module/video
Flue Gas Desulfurization Systems (Scrubbers)	FLORIDA POWER CORPORATION	text
Precipitators, The Why and How	FLORIDA POWER CORPORATION	text

16.0 PERFORM RIGGING FUNCTIONS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Rigging and Lifting	INDUSTRIAL TRAINING CORPORATION	module/video
Handbook for Riggers ISBN 0-9690154-1-0	W. G. NEWBERRY	text
Millwrights and Mechanics Guide ISBN 0-672-23373-8	MACMILLAN COMPANY	text
Industrial Rigging	TPC TRAINING SYSTEMS	trainer/kit
Millwright Instructional Materials, Rigging	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit

17.0 INSTALL AND REMOVE MACHINERY

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Advanced Alignment	INDUSTRIAL TRAINING CORPORATION	module/video
Computerized and Laser Alignment	INDUSTRIAL TRAINING CORPORATION	module/video
Principles of Reverse Double Dial Alignment	INDUSTRIAL TRAINING CORPORATION	module/video
Reverse Double Dial Alignment Procedure	INDUSTRIAL TRAINING CORPORATION	module/video
Vibration Analysis	INDUSTRIAL TRAINING CORPORATION	module/video
Alignment of Axes Kenneth P. Brook	LUDECA, INC.	text
Millwrights and Mechanics Guide ISBN 0-672-23373-8	MACMILLAN COMPANY	text
Mini Alignment Computer Operations Manual	INDUSTRIAL MAINTENANCE SYSTEMS, INC.	text
Millwright Instructional Materials, Machinery	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit

18.0 PERFORM MACHINE SHOP OPERATIONS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
General Machine Shop Practices	INDUSTRIAL TRAINING CORPORATION	module/video
Machine Shop Practice Volume 1 K. H. Moltrecht ISBN 0-8311-1126-7	INDUSTRIAL PRESS, INC.	text
Machine Shop Practice Volume 2 K. H. Moltrecht ISBN 0-8311-1132-1	INDUSTRIAL PRESS, INC.	text
Machinery's Handbook Oberg, Jones and Horton ISBN 0-8311-1200X	INDUSTRIAL PRESS, INC.	text
Machinists' Ready Reference Manual ISBN 0-07-065143-4	McGRAW-HILL BOOK COMPANY	text
The Starrett Book for Student Machinists Cat. No. 1700	L. S. STARRETT COMPANY	text
Millwright Instructional Materials, Machine Shop Operations	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit

19.0 HANDLE AND APPLY LUBRICANTS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Bearings and Lubrication	INDUSTRIAL TRAINING CORPORATION	module/video

Lubrication Guide	TEXTRON, INC., FAFNIR BEARING DIVISION	text
Principles of Lubrication	TPC TRAINING SYSTEMS	trainer/kit

20.0 DEMONSTRATE EMPLOYABILITY SKILLS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
VICA Journal	NATIONAL VICA	magazine
Employability Skills Series (ESS) (CE 001 SS 81)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	module
A Guide to Employability Skills Materials (CE 042 BK 85)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Applying for a Job - Instructor's Guide (CE 004 BK 81)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Applying for a Job - Student Guide (CE 003 BK 79)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Choosing an Occupation - Instructor's Guide (CE 010 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Choosing an Occupation - Student Guide (CE 009 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text

Dictionary of Occupational Titles	U. S. DEPARTMENT OF LABOR EMPLOYMENT AND TRAINING ADMINISTRATION	text
ESS for Success (CE 150 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Employability Skills Leader's Guide: In-service Workshop (CE 205 BK 85)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Employability Skills Participant's Guide: In-service Workshop (CE 074 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Good Work - Instructor's Guide (CE 018 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Good Work - Student Guide (CE 017 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Job Changes - Instructor's Guide (CE 025 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Job Changes - Student Guide (CE 024 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Occupational Outlook Handbook	U. S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS	text

Personal Finances - Instructor's Guide (CE 030 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Personal Finances - Student Guide (CE 029 BK 83)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Your Job Search - Instructor's Guide (CE 038 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Your Job Search - Student Guide (CE 037 BK 84)	FLORIDA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL EDUCATION	text
Millwright Instructional Materials, Employability Skills	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit
Excellence in Training and Employment Louis E. Tice	PACIFIC INSTITUTE, INC.	video

21.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Working Today and Tomorrow - Instructor's Manual ISBN 0-8219-0191-5	EMC PUBLISHING	text
Millwright Instructional Materials, Entrepreneurship	OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION	trainer/kit

PUBLISHERS' ADDRESSES

BENNETT AND McKNIGHT -
GLENCOE PUBLISHING
17337 Ventura Boulevard
Encino, CA 91316

BIDDLE INSTRUMENTS
Blue Bell, PA 19422

CR INDUSTRIES
900 North State Street
Elgin, IL 60120

DANA CORPORATION
551 East Main Street
Hagerstown, IN 47346

DELMAR PUBLISHING
2 Computer Drive West
Albany, NY 12212
518-459-1150

DI/DYNACORP, INC.
5173 26th Avenue
Rockford, IL 61109

EATON CORPORATION
9921 Clinton Road
Cleveland, OH 44144

EMC PUBLISHING
300 York Avenue
St. Paul, MN 55101

FAIRBANKS MORSE PUMP
CORPORATION
3601 Fairbanks Avenue
Kansas City, KS 66110-2918

FALK CORPORATION
5444 Bay Center Drive
Tampa, FL 33609-3402

FEDERAL-MOGUL
CORPORATION
Southfield, MI 48034

FLORIDA POWER CORPORATION
Post Office Box 1287
Crystal River, FL 32629-1287

GOODHEART-WILLCOX
COMPANY, INC.
123 West Taft Drive
South Holland, IL 60473
800-323-0440

GOULDS PUMPS, INC.
240 Fall Street
Seneca Falls, NY 13148

HOUDAILLE INDUSTRIES,
INC., VIKING PUMP
DIVISION
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INC., WARREN PUMPS
DIVISION
Warren, MA 01083

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Broadview, IL 60153

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Pittsburg, PA 15227

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CORPORATION
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JOHN DEERE SERVICE
TRAINING
John Deere Road
Moline, IL 61265

L. S. STARRETT COMPANY
121 Crescent Street
Athol, MA 01331
617-249-3551

LINCOLN ELECTRIC
COMPANY
22801 St. Clair Avenue
Cleveland, OH 44117

LINK-BELT DRIVE
DIVISION
2045 West Hunting Park Avenue
Philadelphia, PA 19140

LUDECA, INC.
1527 Northwest 89th Court
Miami, FL 33172

MACMILLAN COMPANY
866 Third Avenue
New York, NY 10022
212-702-2000

McGRAW-HILL BOOK
COMPANY
1221 Avenue of the Americas
New York, NY 10020
212-512-2000

NATIONAL VICA
Post Office Box 3000
Leesburg, VA 22075

NUS TRAINING
CORPORATION
910 Clopper Road
Gaithersburg, MD 20878-1399

OKLAHOMA STATE DEPARTMENT
OF VOCATIONAL AND
TECHNICAL EDUCATION
State Department of
Vocational Education
Stillwater, OK 74074

PACIFIC INSTITUTE, INC.
Seattle, WA 98101

PARKER HANNIFIN
CORPORATION
17325 Euclid Avenue
Cleveland, OH 44112
216-531-3000

RELIANCE ELECTRIC
COMPANY, DODGE
MANUFACTURING DIVISION
Mishawaka, IN 46544

SKF INDUSTRIES, INC.,
BEARING DIVISION
110 First Avenue
King of Prussia, PA 19406-1352

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501 Madison Road
Cincinnati, OH 45227-1427
513-271-8811

TEXTRON, INC.,
FAFNIR BEARING DIVISION
New Britain, CT 06050

TPC TRAINING SYSTEMS
1301 South Grove Avenue
Barrington, IL 60010

U. S. DEPARTMENT OF LABOR
EMPLOYMENT AND TRAINING
ADMINISTRATION
Washington, DC 20402

U. S. DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS
Washington, DC 20402

UNION CARBIDE
CORPORATION,
LINDE DIVISION
270 Park Avenue
New York, NY 10017

VICKERS, INC.,
TECHNICAL TRAINING
CENTER
1332 Anderson Road
Clawson, MI 48017

W. G. NEWBERRY
Post Office Box 2999
Calgary, Alberta CAN, T2P2M7

WALDES TRUARC, INC.
2901 Borden Avenue
Post Office Box 1030
Long Island City, NY 11101-9990

WINSMITH, DIVISION OF
UMC INDUSTRIES, INC.
Springville, NY 14141

FACILITIES

Facility Design Recommendations

Facilities, tools and equipment are essential parts of training programs, and must be designed to meet State program standard requirements and instructional objectives. This section of the Program Guide contains information for setting up classroom and laboratory facilities. Facility design criteria and space requirements are specified in **S.B.E. Section B, Chapter 6A-2**.

TEACHING FACILITIES

The instructional environment should duplicate, as closely as possible, the real-life work environment the student will enter after graduation. The more the school resembles the industrial environment, the easier it will be for the student to make the transition from school to work. Tools, supplies and equipment should conform to local industry standards. The teacher should actively pursue supplemental resources to expose the students to state-of-the-art equipment.

All facilities should include classroom space, as well as space for regular classroom equipment such as audio-visual equipment. Laboratory facilities should be equipped with work stations or workbenches, tables, chairs and special training aids to demonstrate basic principles and theory. They should contain enough tools and equipment to enable several students to work individually on the same learning activity.

UPDATING FACILITIES

To keep pace with technological changes and improvements, facilities must be updated on a continuing basis. When planning facilities, priority must be given to provide space which will fulfill changing needs of the instructional program. Buildings should be designed with flexibility to expand in order to accommodate future program changes and to allow for greater ease of facility updating. The program advisory committee should be used to assist the school in establishing priorities for obtaining facilities, tools and equipment. Careful planning and analysis of current and future needs will lead to the establishment of an effective training environment.

SCHOOL FACILITIES

Industrial Machinery Maintenance and Repair

This section of the program guide provides guidelines for Industrial Machinery Maintenance and Repair program facilities. All vocational programs must meet additional facility requirements specified in **S.B.E. Section B, Chapter 6 A-2.**

The classroom/laboratory areas should be designed to accommodate oversized machinery, equipment, materials and holding tables. Each area should be equipped with special lighting, as necessary. There should be one or more oversized openings equipped with service entry doors to accommodate the movement or transporting of oversized equipment, materials and machinery.

The laboratory should include electrical outlets providing 110 volts at each work station. Additional electrical outlets should be installed along the walls and in the central area of the laboratory. The electrical outlets in the central laboratory area should be mounted in a permanent manner or on pull down extension systems. Special piping, ventilation and electrical wiring to include 220 and 440 volts may be required due to the diversity of mechanical procedures (pneumatics, hydraulics, etc.) undertaken in an industrial maintenance facility.

CLASSROOM/LABORATORY FACILITIES

Space requirements for new facility construction for this program are specified in **S.B.E. Rule 6A-2.032** as shown below.

NEW FACILITIES
INDUSTRIAL MACHINERY MAINTENANCE AND REPAIR

Occupant Design Stations	20
Net Square Feet Per Occupant	
Minimum	135
Normal	140
Maximum	145
Total Net Square Feet	
Minimum	2700
Normal	2800
Maximum	2900

WORK STATION ARRANGEMENT

The arrangement of work stations and specialized equipment depends upon the general layout of the facilities, but careful consideration must be given to convenience to entrances and exits, easy movement among work stations and tool/storage areas. The area should have a counter convenient to work stations. Overall layout of the facility should be planned so that the location of entrances and exits permits a logical flow of work in progress. One of the most critical factors in planning a facility is the arrangement of work stations to obtain a safe, efficient traffic pattern.

ADDITIONAL FACILITY CONSIDERATIONS

Training Stations

Training stations and live work areas must be available in the type and number required to meet program goals and performance objectives.

Instructional Area

A classroom or designated area of the laboratory should be available for lecture, instruction, viewing audio visual materials and other nonshop activities.

Personal Tool/Equipment Storage Area

A secure storage room or area should be provided, with enough shelf space for student supplies/tool boxes and floor space for equipment.

General Storage

Storage areas for tools, parts, supplies and machines must be sufficient to support the activities outlined in the program goals and performance objectives.

Office Space

An area separate from the classroom and laboratory should be available and convenient for use by the instructor(s) as an office.

Maintenance

A regular facilities maintenance program must be implemented to ensure that equipment and facilities are safe and usable to meet instructional needs.

Housekeeping

The classroom, laboratory and support area(s) must be kept clean and orderly.

Ventilation

A fume/dust removal system should be in place and operable. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning. Ventilation requirements are stated in **S.B.E. Rule 6A-2.066**.

First Aid

A first aid station must be in place, well marked and complete with appropriate supplies.

Support Facilities

Restrooms, clean-up areas and lockers convenient to the shop should be available for students.

Safety

The facilities must meet all Occupational Safety and Health Administration (OSHA) safety standards, where applicable.

Facility Evaluation

The program advisory committee should be asked to conduct an annual evaluation of the facilities to ensure the program's continuing capability to meet instructional objectives.

Safety, Maintenance and Liability

SAFETY

S.B.E. Rule 6A-2.097

The Florida State Board of Education establishes rules for the operation of public schools. **Part III, Section B, Chapter 6A-2** of the State Board of Education Rules contains the standards for existing educational facilities. Subsections deal with the entire school facility in regard to such topics as electrical equipment, flammable materials, ventilation, fire safety, storage and illumination. Subsection 6A-2.097 contains safety regulations pertaining to vocational classes.

The statute requires 100 percent protection of every student and teacher participating in laboratory work wherein the type of activities listed in the statute above are conducted. This will include: demonstration by teachers or students, students and teachers present in a room or laboratory when students are engaged in make-up work or project work, and when anyone is using tools for construction or repair work involving the shaping or cutting of any solid materials.

Special emphasis must be given to the Sight and Hearing Protection requirements as specified in the **State Board of Education Rule 6A-2.0971**. Personal protection devices should be worn by those participating in, observing or in close proximity to laboratory activities.

Marking of Hazardous Areas

Machinery, hoist, stairways, flammable liquid storage closets, equipment using high pressure hoses and areas where sparks or dangerous fumes are created should be properly identified and painted according to the recommended safety standards of OSHA, industry and local codes. Automatically controlled equipment, magnetic switches and all electrical connections must be in compliance with the National Electrical Code (NEC); any variation from the NEC must be in compliance with local electrical codes.

Emergency Procedure For Injuries

The following procedures are recommended in the event of an injury or sudden illness in a student:

- Refer to the red "fire or medical emergency" signs posted in appropriate areas.
- Provide immediate first aid if so qualified.
- Notify appropriate personnel to advise them of the problem. They can also contact emergency trained personnel on campus.
- A conscious person has the right to refuse treatment and/or transportation to a medical facility.
- Advise students that they will be financially responsible for ambulance and emergency care.
- The paramedics will assume patient care upon arrival.
- If emergency transportation is not indicated, the student may spend time at the clinic, be allowed to go home or go to a medical facility.
- Be sure to complete the appropriate student injury form for any and all accidents or sudden illness.

MAINTENANCE

Schools should have the necessary facilities for routine maintenance. Special maintenance requirements for this program concern the hand and power tools and machines. Arrangements must be made to accomplish routine and non-routine maintenance of hand and power tools and cutting and shaping machines. Arrangements can be made through the school's shop or an outside agency.

VOCATIONAL TEACHER LIABILITY

Liability of Teacher and School Board

Negligence of vocational education teachers can cause unnecessary injury, and may result in teacher and school district liability. Vocational teachers are recommended to carry personal liability insurance. To reduce the risk of liability and injuries, the following suggestions are provided.

- Follow accepted policies of the school board.
- Do not allow students to use equipment or tools which have not been approved by the administration and Board of Education.
- Establish safety rules and enforce them.
- Do not leave the shop/laboratory while students are working.
- Do not permit non-enrolled students to use the shop/laboratory.
- Do not allow students to use machines or tools for which instruction has not been given.
- Do not approve unsupervised student activities inside or outside the shop/laboratory.
- Prepare accident forms for all accidents.
- Regularly inspect the workplace and equipment for defects or potential hazards and maintain documentation of unserviceable or hazardous items.
- Consider age, maturity, skill and ability of students when providing instruction and supervision.
- Administer safety tests to students upon completion of the demonstration of a specific machine, tool or process and keep documentation on file in your office.
- Require all students to wear eye protection devices, when appropriate, for laboratory activities.

SUGGESTED EQUIPMENT LIST

General Classroom Equipment

DESCRIPTION

Chalkboard

Bulletin board

Bookcases

Cabinet-storage

Student study stations

Audio-visual equipment as needed

Laboratory Tools and Equipment

These tools and items of equipment are normally used in this program. Equipment items are listed under each outcome, corresponding to the curriculum framework. Consumable supplies should be readily available to assure continuous instruction. Consumable supplies such as solder and wire are not contained in the equipment list.

01.0 READ BLUEPRINTS AND SCHEMATICS

DESCRIPTION

Scale, architect
Scale, engineer
Triangle, 30/60 degree
Triangle, 45 degree

02.0 APPLY MATHEMATICS, PHYSICS AND METALLURGY SKILLS

DESCRIPTION

Calculator, digital

03.0 UTILIZE AND MAINTAIN HAND TOOLS

DESCRIPTION

Cabinet, tool
Calipers, Vernier, 12 inch
Calipers, Vernier, 5 inch
Calipers, hermaphrodite
Calipers, spring-bow, inside, 0 to 3 inch
Calipers, spring-bow, outside, 0 to 3 inch
Cutters, bolt, 24 inch
Cutters, diagonal
Dial indicator
Dividers, spring-bow, 0 to 12 inch
Dividers, spring-bow, 0 to 3 inch
Dividers, spring-bow, 0 to 6 inch
Extractors, screw
Extractors, tape
File cards
Files
Gage, drill point
Gage, gear tooth pitch
Gage, micrometer depth, 0 to 3 inch
Gage, screw pitch
Gage, small hole set, 1/8 to 1/2 inch
Gage, telescoping, 1/4 to 3 inch
Gage, thickness, .0015 to .025 inch
Hammer, ball-peen, 24 ounce
Hammer, ball-peen, 8 ounce
Hammer, claw
Hammer, claw, 20 ounce
Hammer, soft
Head for combination square, center
Head for combination square, protractor
Magnetic bases for dial indicators
Micrometers, 0 to 1 inch
Micrometers, 1 to 2 inch
Micrometers, 2 to 3 inch
Mirrors, inspection

Pliers, channel-lock
Pliers, external, retaining ring
Pliers, internal, retaining ring
Pliers, needle-nose
Pliers, regular nose
Prybar
Punch and chisel set
Rules, steel, 150 mm
Rules, steel, 6 inch
Saw, hacksaw
Saw, hand
Screwdriver set, phillips
Screwdriver set, regular
Scribe, pocket
Snips, aviation
Snips, tin
Socket set, 1/2 inch drive
Socket set, 1/4 inch drive
Socket set, 3/8 inch drive
Square, combination
Tap and die sets
Tape, steel, 16 foot
Trammel points, adjustable
Vise grips
Wrench set, allen
Wrench set, combination
Wrench set, metric
Wrench set, slugging
Wrench, adjustable end, 18 inch
Wrench, pipe, 10 inch
Wrench, pipe, 14 inch
Wrench, pipe, 18 inch
Wrench, strap

04.0 UTILIZE AND MAINTAIN PORTABLE POWER TOOLS

DESCRIPTION

Drill, electrical, 1/2 inch
Drill, electrical, 3/8 inch
Drill, magnetic base, 1/2 inch
Grinder, electric, portable, 7 inch
Sander-grinder, 4 1/2 inch
Saw, electric, 7 1/4 inch
Saw, jig
Saw, reciprocating

05.0 PERFORM GAS AND ARC WELDING PROCEDURES

DESCRIPTION

Booths, welding, with ventilation
Clamp, "C"
Goggles, welding
Grinder, pedestal, 10 inch
Hammer, chipping
Helmets, welding
Rig, oxy-acetylene
Screen, welding, portable
Square, framing
Welders, arc, AC/DC, 250 amp

06.0 DEMONSTRATE KNOWLEDGE OF BASIC ELECTRICITY AND ELECTRONICS

DESCRIPTION

Megger, insulation tester, multipurpose
Meter, analog, clamp on
Meter, multimeter
Motors, single phase and three phase
Pliers, wire sleeve crimping
Pliers, wire stripping
Soldering gun, electric, kit
Training aid, analog multimeter
Training aid, motor starter, consisting of disconnect, pushbuttons, control relay, magnetic starters and motors

07.0 INSTALL AND MAINTAIN DRIVE COMPONENTS

DESCRIPTION

Bearing separator
Bearings, anti-friction
Bearings, plain
Chain breaker tool
Couplings
Drives, variable speed
Gear pullers
Gear reducer, parallel shaft

Gear reducer, worm
Induction bearing heater
Roller chain
Sheaves, v-belt
Sprockets
Tachometer/speed indicator

08.0 PERFORM PUMP MAINTENANCE AND REPAIR

DESCRIPTION

Pump packing hooks
Pump, centrifugal, double-suction
Pump, centrifugal, end-suction
Pump, circulating
Pump, positive displacement
Pump, vertical turbine

09.0 MAINTAIN PIPING AND TUBING

DESCRIPTION

Bender, tubing
Copper tubing and fittings
Cutter, pipe
Galvanized pipe and fittings
Pipe threading machine, portable, 1/2 to 2 inch
Ratchet with handles and die sets for 1/8, 1/4, 3/8, 1/2, 3/4 and 1 inch NPT
Reamer, pipe
Torches, propane, with fuel cylinders
Tube cutting and flaring set

10.0 MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS

DESCRIPTION

Actuator, hydraulic
Pump, hydraulic

Training aid, hydraulic, consisting of pump, reservoir,
    filters, gages, pressure relief valve, manual and solenoid
    directional valves, flow control valves and rotary and
    linear actuators
Valve, hydraulic

11.0 TROUBLESHOOT HYDRAULIC SYSTEMS

DESCRIPTION

NONE

12.0 MAINTAIN RECIPROCATING, POSITIVE DISPLACEMENT, ROTARY AND DYNAMIC AIR COMPRESSORS

DESCRIPTION

Air compressor components, centrifugal
Air compressor components, reciprocating
Air compressor components, rotary

13.0 TROUBLESHOOT PNEUMATIC SYSTEMS

DESCRIPTION

Training aid, pneumatic systems, consisting of filters,
    lubricators, regulators, directional valves, speed controls
    and actuators

14.0 MAINTAIN AND TROUBLESHOOT FLUID DRIVE SYSTEMS

DESCRIPTION

Drives, fluid, adjustable speed
Fluid couplings

15.0 DEMONSTRATE A KNOWLEDGE OF THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYTEMS

DESCRIPTION

Baghouses (observed during field trips to industry)
Precipitators (observed during field trips to industry)
Scrubbers (observed during field trips to industry)
Solid waste treatment equipment (observed during field trips to industry)
Sound control (observed during field trips to industry)

16.0 PERFORM RIGGING FUNCTIONS

DESCRIPTION

Cable clamps
Cable, stranded, 1/4 inch
Cable, stranded, 3/8 inch
Chain, 1/4 inch
Chain, 3/8 inch
Chain, double, with masterlink one end, sling hooks other ends, 3/8 inch X 5 feet
Eye bolts
Hooks
Shackles
Sling, nylon, endless loop, 1 inch X 6 feet
Sling, nylon, eye and eye, 2 inch X 6 feet
Sling, wire rope, eye and eye, 3/8 inch X 6 feet

17.0 INSTALL AND REMOVE MACHINERY

DESCRIPTION

Alignment kit, computer, with system, brackets and indicators
Alignment kit, laser, with brackets, laser/detector, prism, level, computer and beam finder
Alignment kit, training aid, consisting of fixed and movable machines and shaft coupling
Cylinder ram, 5 ton, with hydraulic hand pump
Engineer rod

Gage, taper
Level, 24 inch
Level, line
Level, machinist, precision
Level, torpedo, magnetic, 9 inch
Mounting brackets, dial indicator, for shaft alignment
Pinch bar, 60 inch
Plumb bob
Puller, cable, ratchet, single-line, 1/2 ton
Puller, chain, 3/4 ton
Shim kit, precut, .001 to .125 inch
Tape, steel, 100 foot
Tripod and transit

18.0 PERFORM MACHINE SHOP OPERATIONS

DESCRIPTION

Air compressor
Bench stones
Cabinet, parts
Cabinet, safety storage
Cart, service
Cutters, milling
Dressers, grinding wheel
Drill bit set, H.S., 1/16 to 1/2 inch
Drill bit set, H.S., 1/2 to 1 inch
Drill bit set, H.S., letters A to Z
Drill bit set, H.S., number 1 through 60
Drill set, countersinking
Gage, 60 degree, center
Grinder, bench, 8 inch
Grinder, pedistol, 8 inch
Hoist, hydraulic boom, portable
Hoist, manually-operated chain, 2 ton, with portable A-frame
Lathe, engine, 12 inch (minimum), with three jaw and four jaw chucks, face plates, tool holders, steady rest, follower rest and live centers
Mill, vertical, 3 HP
Parts washer tank, 15 gallon
Press, arbor, 2 ton
Press, drill, floor model, 3/4 inch
Press, hydraulic, vertical, 30 ton
Reamer, taper pin
Safety cans, flammable liquid, 2 gallon
Saw, band, horizontal metal cut-off
Scale, surface roughness
Spray, eye and face

Tool boxes
Tool set, counterboring
Truck, hand
Truck, steel platform, 2500 pounds capacity
Vise, drill press, 4 1/2 inch
Waste cans, oily
Work benches, steel, with vises

19.0 HANDLE AND APPLY LUBRICANTS

DESCRIPTION

Gear pump and reservoir for lubricant transfer
Grease guns, heavy duty
Oilers, pistol grip

20.0 DEMONSTRATE EMPLOYABILITY SKILLS

DESCRIPTION

NONE

21.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP

DESCRIPTION

NONE

PROFESSIONAL DEVELOPMENT

Teacher Technical Updating

Technical updating workshops are scheduled periodically throughout the State, usually in the summer months. Teachers should take advantage of the opportunity to attend the program technical update workshops when they are held. All instructional staff are encouraged to participate in as many training opportunities as possible.

Teachers should seek opportunities with local companies to maintain currency with industry trends. During periods when school is not in session, teachers are encouraged to make arrangements to return to industry for suitable involvement in their area of expertise.

Membership in professional associations offers vocational educators an enormous range of opportunities for working together to strengthen the field and to develop personal competence and satisfaction in work. The associations have similar goals and activities. They seek excellence in program content by means of joint efforts among members, communications that keep members current, forums for the discussion of issues in the field, useful and stimulating publications and sound professional growth experiences at local, state, regional and national meetings and annual conventions. They are concerned with increasing public understanding and support of the field. Teachers are encouraged to maintain affiliation with professional organizations. A list of professional organizations follows this section of the guide.

Teacher Standards

As a prerequisite to certification, teachers must have the required years of experience in the appropriate technical field as defined in the certification standards. For the Industrial Machinery Maintenance and Repair program, the requirements are six years continuous experience in industrial machinery maintenance and repair. The teacher is then judged qualified to teach upon meeting one of the following criteria: (1) regular or temporary Florida teacher's certificate with appropriate coverage, (2) approval of local school board consistent with adopted school policy or (3) regular or temporary Florida teacher's certificate with other than appropriate coverage (has met all occupational experience requirements prescribed as a prerequisite to appropriate certification and has been approved by the school board to teach out-of-field). Refer to the Curriculum Framework for this program to determine the appropriate occupational specialization coverage required for certification.

Instructional staff must have technical competency and meet all State and local requirements for certification. Instructors should hold current, nationally recognized certification in the subject areas taught, if awarded. Beginning teachers must be enrolled in the State Beginning Teacher Program.

A systematic method of obtaining "substitute" instructors, approved by the school board, should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent instructor in the occupational area and specific competencies taught.

Professional Organizations and Support Services

EDUCATION ORGANIZATIONS

AMERICAN VOCATIONAL ASSOCIATION (AVA)
1410 King Street
Alexandria, VA 22314
800-826-9972

FLORIDA ASSOCIATION FOR TRADE AND INDUSTRIAL EDUCATION, INC. (FATIE)
Florida Department of Education
Industrial Education - Vocational Division
Knott Building
Tallahassee, FL 32399
904-488-0484

FLORIDA VOCATIONAL ASSOCIATION (FVA)
1420 North Paul Russell Road
Tallahassee, FL 32399
904-878-6860

FLORIDA VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)
Florida Department of Education
Knott Building
Tallahassee, FL 32399
904-488-0484

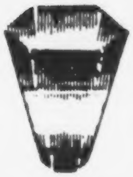
TRADE ORGANIZATIONS

This list contains trade associations and technical societies. Many offer training programs of some sort, either directly or through their member companies. Specific details should be requested in writing.

AMERICAN MACHINE TOOL DISTRIBUTORS ASSOCIATION
4220 Montgomery Lane
Bethesda, MD 20814
301-654-1200

AMERICAN SUPPLY AND MACHINERY MANUFACTURERS ASSOCIATION
1230 Keith Building
Cleveland, OH 44115-2180
216-241-7333

MECHANICAL CONTRACTORS ASSOCIATION OF AMERICA (MCMA)
5410 Grosvenor Lane, Suite 12
Bethesda, MD 20814



State of Florida
Department of Education
Tallahassee, Florida
Betty Castor, Commissioner
Affirmative action/equal opportunity employer

IE567 BK-91

CAREER MERIT ACHIEVEMENT PLAN (CAREER MAP)

INDUSTRIAL MACHINERY MAINTENANCE AND REPAIR

(0647.030300)

STUDENT'S NAME

State of Florida

An affirmative action/equal opportunity employer

DEPARTMENT OF EDUCATION
Betty Castor, Commissioner of Education

DIVISION OF VOCATIONAL, ADULT AND COMMUNITY EDUCATION
Robert S. Howell, Director

DEVELOPED BY:
University of South Florida
Department of Adult and Vocational Education

INDUSTRY-BASED PARTNERSHIP PROGRAMS: The State of Florida is committed to the development of industry-based partnership programs, designed by education and industry to respond to industry's demand for a highly skilled work force.

ACKNOWLEDGEMENTS

The curriculum for the Industrial Machinery Maintenance and Repair program was developed by the Florida Department of Education with assistance from representatives from industry and vocational education instructors.

For further information, contact
Bureau of Vocational Program and Staff Development
Division of Vocational, Adult, and Community Education
Department of Education
Knott Building
Tallahassee, FL 32399

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CONTENTS

ACKNOWLEDGEMENTS. i

IDENTIFICATION PAGE. 2

JOB TITLES. 2

OVERVIEW. 3

PURPOSE OF THE MAP. 3

HOW TO USE THE MAP. 3

RATING STUDENT PERFORMANCE STANDARDS. 4

INDUSTRIAL MACHINERY MAINTENANCE AND REPAIR PROGRAM CONTENTS. . . 5

- 01.0 READ BLUEPRINTS AND SCHEMATICS. 5
- 02.0 APPLY MATHEMATICS, PHYSICS AND METALLURGY SKILLS. 5
- 03.0 UTILIZE AND MAINTAIN HAND TOOLS. 6
- 04.0 UTILIZE AND MAINTAIN PORTABLE POWER TOOLS. 6
- 05.0 PERFORM GAS AND ARC WELDING PROCEDURES. 7
- 06.0 DEMONSTRATE KNOWLEDGE OF BASIC ELECTRICITY AND ELECTRONICS. 8
- 07.0 INSTALL AND MAINTAIN DRIVE COMPONENTS. 8
- 08.0 PERFORM PUMP MAINTENANCE AND REPAIR. 10
- 09.0 MAINTAIN PIPING AND TUBING SYSTEMS. 10
- 10.0 MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS. 11
- 11.0 TROUBLESHOOT HYDRAULIC SYSTEMS. 12
- 12.0 MAINTAIN RECIPROCATING, POSITIVE DISPLACEMENT, ROTARY AND DYNAMIC AIR COMPRESSORS. 12
- 13.0 TROUBLESHOOT PNEUMATIC SYSTEMS. 13
- 14.0 MAINTAIN AND TROUBLESHOOT FLUID DRIVE SYSTEMS. 14
- 15.0 DEMONSTRATE A KNOWLEDGE OF THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYSTEMS. 14
- 16.0 PERFORM RIGGING FUNCTIONS. 15
- 17.0 INSTALL AND REMOVE MACHINERY. 15
- 18.0 PERFORM MACHINE SHOP OPERATIONS. 16
- 19.0 HANDLE AND APPLY LUBRICANTS. 17

P.O.W.E.R. SKILLS (PRINCIPLES OF WORK ENVIRONMENT READINESS). . . . 19

- 0. DEMONSTRATE EMPLOYABILITY SKILLS. 19
- 00. DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP. . . 19
- 000. COOPERATIVE WORK EXPERIENCE COMPETENCIES. 20

VERIFICATION. 21

COOPERATIVE WORK EXPERIENCE. 22

NOTES. 23

THIS MERIT ACHIEVEMENT PLAN RECORDS THE INDUSTRIAL MACHINERY MAINTENANCE AND REPAIR ACHIEVEMENTS OF:

Student's Name ____

Student ID Number ____

Student's Address ____

____

Initial Instructor ____

School ____

Date Started ____

PRIMARY JOB TITLE(S) FOR INDUSTRIAL MACHINERY MAINTENANCE AND REPAIR

- Millwrights (85123626)
- Maintenance Mechanics DOT#(629.280-010)
- Machinery Erectors DOT#(638.261-014)

Program completers qualify for the primary job title(s) listed above. Related job titles may be added based on those job titles found in industry and/or the Dictionary of Occupational Titles.

OVERVIEW

This Career MAP includes the competencies required for entry into the field of industrial machinery maintenance and repair. Business and industry representatives have recommended that students in this field master these competencies in order to become employable. Local education agencies (LEAs) may adapt these competencies to meet their workforce needs.

PURPOSE OF THE MAP

The purposes of the MAP are: to display the student performance standards (SPS) required by the LEA and to document the level of achievement on student performance standards that the student demonstrates.

HOW TO USE THE MAP

Administrator and Instructor. The administrator and instructor can use Career MAPs in curriculum planning, program updating and improvement and teacher recruitment, selection and updating. If the LEA changes or adds student performance standards, the revised or additional student performance standards should be included in the blank boxes that appear within each intended outcome or at the end of this MAP.

Instructor. The instructor can use Career MAPs to keep track of student progress on student performance standards. By periodically reviewing the ratings on student performance standards, the instructor can identify a student's strengths and weaknesses and, on that basis, identify the skills for which the student needs remedial instruction or advanced training. The MAP can also be useful in student counseling and evaluation.

Co-op Instructor/Employer. The employer who sponsors a co-op program should use the Career MAP for keeping a record of the student's performance on appropriate standards. The MAPs will also help the co-op instructor/employer in counseling and evaluating the student.

Student. The student may use the MAP to show potential employers the performance standards he or she has mastered. In order to present a complete record, the student should encourage the instructor/co-op employer to rate his or her level of achievement on all the appropriate student performance standards and to fill in the verification form/cooperative work experience page in the back of this MAP.

Employer. The MAP shows an employer the student performance standards mastered by the student (a prospective employee) and the proficiency level achieved on each student performance standard. This information can help the employer make decisions about hiring, job assignments and job-training needs.

RATING STUDENT PERFORMANCE STANDARDS

Performance Competencies. Ratings on student performance standards should be based upon business/industrial performance standards. The evaluator observes and evaluates student performance as he or she would in the role of the employer or supervisor.

For each skill listed the learner receives a rating of 1, 2 or 3. Each rating indicates a particular level of achievement:

1 = Learner demonstrates knowledge and understanding of this student performance standard, but is not yet able to apply that knowledge or understanding.

2 = Learner performs this student performance standard satisfactorily with only periodic supervision.

3 = Learner performs this student performance standard satisfactorily without supervision.

Whenever a performance standard is demonstrated, the instructor checks the appropriate rating box (1, 2 or 3) and initials and dates the verification line. If the student later demonstrates a higher level of achievement on a performance competency, the instructor checks the higher level and then enters his or her initials and the new date on the verification line, as shown in the following example:

03.05
Utilize sheetmetal tools.
1 ☐
2 ☑
3 ☑
K ☐
10-8-91 10-22-91
Verification

Knowledge Competencies. For each SPS that is a knowledge competency only, with no manipulative skill involved, only one level of achievement is possible. If the student masters the competency, he or she receives a check in the bottom box ("K"), as shown below:

01.01
Explain the purpose of blueprints.
1 ☐
2 ☐
3 ☐
K ☑
9-24-91
Verification

NOTE: A student performance standard without a checked rating indicates that the learner has not mastered the standard from lack of either ability, time, opportunity or need (the student's area of specialization may not have required it).

01.0 READ BLUEPRINTS AND SCHEMATICS.

01.01 Explain the purpose of blueprints. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.02 Examine & interpret machine parts & machine drawings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.03 Read & interpret machine assembly drawings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
01.04 Read & interpret building drawings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.05 Read & interpret schematics & symbols. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.06 Read & interpret electrical diagrams. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
01.07 Read a piping schematic. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.08 Identify fluid power system component symbols & interpret diagrams. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.09 Prepare field sketch of a machine part. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

02.0 APPLY MATHEMATICS, PHYSICS AND METALLURGY SKILLS.

02.01 Add, subtract, multiply & divide positive & negative numbers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.02 Add, subtract, multiply & divide fractions. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.03 Change mixed numbers to decimals & vice versa. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
02.04 Develop & interpret ratios. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.05 Apply entry level geometric functions. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.06 Solve entry level algebraic equations. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

INDUSTRIAL MACHINERY MAINTENANCE
AND REPAIR

02.07 Apply metric & linear measurement. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.08 Describe mechanical & chemical properties of ferrous & non-ferrous metals. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.09 Describe the properties & uses of toxic & flammable materials. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

03.0 UTILIZE AND MAINTAIN HAND TOOLS.

03.01 Demonstrate safe use of hand tools. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.02 Utilize measuring devices. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.03 Utilize wrenches & screwdrivers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
03.04 Utilize pipefitting tools. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.05 Utilize sheetmetal tools. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.06 Demonstrate the use of ropes, slings, pulleys & block & tackle. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

04.0 UTILIZE AND MAINTAIN PORTABLE POWER TOOLS.

04.01 Demonstrate safe use of portable power tools. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.02 Utilize & maintain light-duty & heavy-duty drills. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.03 Utilize & maintain electric hammers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

04.04 Utilize & maintain pneumatic drills & hammers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.05 Utilize & maintain power screwdrivers, nut runners. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.06 Utilize & maintain linear motion saws. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
04.07 Utilize & maintain circular saws. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.08 Utilize & maintain belt, pad & disc sanders. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.09 Utilize & maintain grinders & shears. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

05.0 PERFORM GAS AND ARC WELDING PROCEDURES.

05.01 Demonstrate safety procedures for performing gas & arc welding. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.02 Identify components of oxyfuel rig. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.03 Set up & shut down oxyfuel rig. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
05.04 Weld beads in flat position. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.05 Weld outside corner joint using a filler rod. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.06 Cut metal of various thicknesses. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
05.07 Weld beads in flat position using E-6010 & E-7018 electrodes. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.08 Weld beads in horizontal & in vertical positions using E-6010 & E-7018 electrodes. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.09 Weld beads in overhead position using E-6010 & E-7018 electrodes. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
05.10 Solder & braze metals. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

06.0 DEMONSTRATE KNOWLEDGE OF BASIC ELECTRICITY AND ELECTRONICS.

06.01 Define electrical/ electronic terms. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.02 Explain the theory & application of magnetism. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.03 Explain Ohm's Law. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
06.04 Describe DC & AC circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.05 Disconnect & reconnect electric motors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.06 Demonstrate an entry level understanding of electrical control equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
06.07 Utilize & maintain ammeters, milliameters, voltmeters, & ohmmeters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

07.0 INSTALL AND MAINTAIN DRIVE COMPONENTS.

07.01 Demonstrate safety procedures for installing & maintaining drive components. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.02 Identify types of bearings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.03 Remove, inspect and/or replace bearings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

07.04 Remove & replace seals. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.05 Perform shaft alignment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.06 Identify types of belts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
07.07 Identify types of chains. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.08 Perform tension adjustments on belt & chain drives. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.09 Troubleshoot belts & chain drives. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
07.10 Remove, replace & align couplings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.11 Identify types of gears. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.12 Remove/replace gears. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
07.13 Adjust gear backlash. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.14 Troubleshoot gear drives. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.15 Disassemble, inspect, reassemble & adjust clutches. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
07.16 Identify types of variable speed drives. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.17 Troubleshoot variable speed drives. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.18 Identify types of cams & link mechanisms. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
07.19 Troubleshoot cam & link mechanism problems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

08.0 PERFORM PUMP MAINTENANCE AND REPAIR.

08.01 Demonstrate safety procedures for performing pump maintenance. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.02 Determine pump capacity & system requirements (entry level). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.03 Perform pump maintenance. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
08.04 Identify packing & seal requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.05 Explain operating principles of centrifugal, propeller & turbine rotary, reciprocating & metering pumps. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.06 Disassemble & reassemble a pump. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

09.0 MAINTAIN PIPING AND TUBING SYSTEMS.

09.01 Identify components of a piping system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.02 Explain maintenance considerations of metallic & non-metallic piping systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.03 Join copper tubing. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
09.04 Join common fittings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.05 Join metallic pipe. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.06 Join plastic pipe. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
09.07 Explain valve operation & maintenance. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.08 Explain importance of strainers, filters & traps in piping systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

10.0 MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS.

10.01 Explain safety procedures for installing hydraulic lines. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.02 Explain Pascal's Law. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.03 Explain Bernoulli's Principle. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
10.04 Explain how heat & pressure relate to power & transmission. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.05 Describe physical & chemical properties of a fluid. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.06 Install & maintain a contaminate removal system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
10.07 Determine reservoir requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.08 Classify & select pumps for specific applications. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.09 Compute hose requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
10.10 Install hydraulic lines. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.11 Select & install control valves. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

INDUSTRIAL MACHINERY MAINTENANCE AND REPAIR

11.0 TROUBLESHOOT HYDRAULIC SYSTEMS.

11.01 Explain safety procedures for troubleshooting hydraulic systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.02 Read a hydraulic schematic. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.03 Install hydraulic components. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
11.04 Connect electrically controlled valves. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.05 Explain hydraulic system troubleshooting techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.06 Repair & replace valves. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
11.07 Repair & replace cylinders. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.08 Repair & replace pumps & motors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.09 Cut, flare & bend tubing. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

12.0 MAINTAIN RECIPROCATING, POSITIVE DISPLACEMENT, ROTARY AND DYNAMIC AIR COMPRESSORS.

12.01 Relate force, weight, mass & density to a pneumatic system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	12.02 Explain the operation of reciprocating compressors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	12.03 Explain the operation of positive-displacement rotary compressors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
12.04 Explain primary & secondary air treatment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	12.05 Explain the operation of valves, cylinders & motors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

13.0 TROUBLESHOOT PNEUMATIC SYSTEMS.

13.01 Explain safety procedures for troubleshooting pneumatic systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	13.02 Identify common schematic symbols & diagrams. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	13.03 Diagram an air supply system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
13.04 Install system components. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	13.05 Explain system maintenance techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	13.06 Explain proper troubleshooting procedures. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
13.07 Troubleshoot air compressors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	13.08 Troubleshoot control valves. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	13.09 Troubleshoot, repair & install control valves. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
13.10 Troubleshoot air motors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

14.0 MAINTAIN AND TROUBLESHOOT FLUID DRIVE SYSTEMS.

14.01
Explain safety procedures for maintaining & troubleshooting fluid drive systems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.02
Install adjustable speed drives.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.03
Troubleshoot adjustable speed drives.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.04
Explain operation of fluid couplings.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.05
Install fluid couplings.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.06
Install torque converters.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.07
Perform preventative maintenance.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.08
Select adequate substitute bearings when required to restore motor operation.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.09
Align motor shafts, couplings, pulleys, drive sheaves & guards on both parallel & in-line shafts.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.10
Apply "dynamic" magnetic/mechanical braking device to a motor.
1 ☐
2 ☐
3 ☐
K ☐
Verification

14.11
Mount equipment.
1 ☐
2 ☐
3 ☐
K ☐
Verification

1 ☐
2 ☐
3 ☐
K ☐
Verification

1 ☐
2 ☐
3 ☐
K ☐
Verification

1 ☐
2 ☐
3 ☐
K ☐
Verification

1 ☐
2 ☐
3 ☐
K ☐
Verification

15.0 DEMONSTRATE A KNOWLEDGE OF THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYSTEMS.

15.01
Explain the operation of air pollution control systems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

15.02
Explain the operation of water pollution control systems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

15.03
Explain the operation of solid waste pollution control systems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

15.04 Explain the operation of noise pollution control systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

16.0 PERFORM RIGGING FUNCTIONS.

16.01 Demonstrate safety procedures for performing rigging operations. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	16.02 Identify & inspect fiber & wire rope. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	16.03 Tie knots & hitches. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
16.04 Identify & use components of rigging hardware. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	16.05 Perform rigging operations. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

17.0 INSTALL AND REMOVE MACHINERY.

17.01 Identify safety procedures for installing & removing machinery. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.02 Identify equipment required for machine installation/ removal. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.03 Prepare area for machine installation per manufacturer's specifications. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

17.04 Rig, lift & transport machinery to installation site. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.05 Align machinery using wire-line, transit, dial indicators, computer & laser alignment devices. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.06 Position & secure machinery on foundation. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
17.07 Level machinery & install balance/vibration dampeners. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.08 Install electrical hookups to machinery. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.09 Install air/hydraulic hookups to machinery. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
17.10 Perform assigned machine retrofit per manufacturer's specifications. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.11 Perform assigned machine removal & transport per specification requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.12 Demonstrate proficiency in vibration detection. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

18.0 PERFORM MACHINE SHOP OPERATIONS.

18.01 Demonstrate safety in performing machine shop operations. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.02 Drill holes using drill press. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.03 Identify types of cutting tools. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
18.04 Bore a hole to a specified size. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.05 Chase an external V-thread. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.06 Identify different types of work holding devices. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
18.07 Prepare metal for finishing. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.08 Sharpen drill bit. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

82

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

19.0 HANDLE AND APPLY LUBRICANTS.

19.01 Explain the functions of lubrication. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	19.02 Explain the properties of oil lubricants & factors determining the selection of lubricants. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	19.03 Identify the types, advantage & functions of lubricant additives. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
19.04 Explain the types of circulating oils & their purposes. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	19.05 Identify grease application. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	19.06 Identify lubricating systems & methods. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
19.07 Explain lubricant storage & handling methods. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	19.08 Lubricate a piece of industrial equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

P.O.W.E.R. SKILLS (PRINCIPLES OF WORK ENVIRONMENT READINESS)

0.0 DEMONSTRATE EMPLOYABILITY SKILLS.

0.01 Conduct a job search. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.02 Secure information about a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.03 Identify documents that may be required when applying for a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
0.04 Complete a job application form correctly. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.05 Demonstrate competence in job interview techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
0.07 Identify acceptable work habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.08 Demonstrate knowledge of how to make job changes appropriately. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.09 Demonstrate acceptable employee health habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP.

00.01 Define entrepreneurship. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.02 Describe the importance of entrepreneurship to the American economy. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.03 List the advantages & disadvantages of business ownership. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
00.04 Identify the risks involved in ownership of a business. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.05 Identify the necessary personal characteristics of a successful entrepreneur. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.06 Identify the business skills needed to operate a small business efficiently & effectively. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

000.0 COOPERATIVE WORK EXPERIENCE COMPETENCIES.

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

VERIFICATION

The instructor should verify the level of mastery achieved by the student by initialing the competency box each time the student masters a competency. Later, if the student achieves a higher degree of mastery of a competency, the higher degree should be recorded and verified by the instructor.

INSTRUCTOR SHOULD SIGN FULL NAME AND SCHOOL NAME AND ADDRESS IN THE SPACE BELOW.

Verification
Signature
Title
School Name
School Address

Verification
Signature
Title
School Name
School Address

Verification
Signature
Title
School Name
School Address

COOPERATIVE WORK EXPERIENCE

In addition to classroom training and laboratory performance identified on the Career MAP, this student has participated in cooperative work experience with employers as shown below:

Dates
Employer
Address of Employer
Supervisor
Supervisor Title

Dates
Employer
Address of Employer
Supervisor
Supervisor Title

Dates
Employer
Address of Employer
Supervisor
Supervisor Title

NOTES

This section of the MAP is provided so the instructor, employer, or student may list additional qualifying statements or other pertinent information. All comments should be initialed for verification.

State of Florida
Department of Education
Tallahassee, Florida
Betty Castor, Commissioner
Affirmative action/equal opportunity employer

IE576 BK-91